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IEEE Transactions on Medical Imaging
Special Issue on Score-based Generative Models for Medical Imaging

The conventional wisdom of machine learning/deep learning (ML/DL) is that, given a dataset, one can learn a prior on the data distribution in the supervised or self-learning mode, utilizing similarities among latent features of the data. However, an important particularity in the medical imaging settings is that data are highly diverse as collected using different imaging scanners/protocols or of different populations at different institutions. It means that the distribution of these diverse data is too complex to be represented by a one-for-all prior using any classic method, which results in limited generalizability in medical imaging tasks. As such, there is a pressing need for novel, powerful methods to learn generalizable priors that characterize highly complicated datasets accurately and reliably. In this regard, the recently emerging score-based diffusion and other generative models show great promise for Bayesian modeling and inference in general, and medical imaging in particular. Furthermore, the theory behind score-based generative models provides a rigorous yet interpretable approach to understand how these models work. At the same time, existing score-based generative models face several practical challenges including reliance on high-quality training images, computationally inefficient image sampling, and suboptimal performance with physics-agnostic architectures. Therefore, it is highly desirable to develop novel physics-driven score-based diffusion and other generative models with improved architectures, learning strategies and sampling efficiency, and sculpt them to offer reliable performance in medical imaging applications.

This Special Issue focuses on innovative methodological and computational advancements of score-based diffusion and other generative models for medical imaging. We are looking for technical contributions that report novel score-based generative models that address current limitations in performance, efficiency, and interpretation. Contributions should demonstrate how these novel models empower leaps in AI-based medical imaging and help translate them from research into clinics. Topics of interest include but are not limited to:

- Novel score-based generative models for inverse problems in medical imaging (e.g., denoising, deblurring, reconstruction, artifact reduction, etc.)
- Novel score-based generative models for other medical imaging tasks (e.g., image segmentation, multi-modal image translation, functional imaging, quantitative imaging etc.)
- Interpretation techniques for score-based generative models in medical imaging (e.g.,optimal transport (OT), Schrödinger's bridge (SB), etc.)
- Novel efficient image sampling algorithms for score-based generative models in medical imaging (e.g., distillation techniques, consistency models, etc.)
- Physical principles-driven score-based generative models (e.g., physics of magnetic resonance imaging, computed tomography, etc.)
- Novel learning strategies for score-based generative models (e.g., unpaired/zero-shot/self-supervised learning, etc.)

Authors must submit papers on ScholarOne according to the instructions here. Please choose "Special Issue on Diffusion Models for Medical Imaging" as the manuscript type in the submission process. Four reviewers will be typically recruited according to the standard TMI review protocol. Authors are encouraged to discuss with one of the guest editors to determine suitability for this special issue.

Guest Editors

Dong Liang, Lead Guest Editor, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China
dong.liang@siat.ac.cn

Daniel Rueckert, Technical University of Munich, Germany.
daniel.rueckert@tum.de

Ge Wang, Rensselaer Polytechnic Institute, USA
wangg6@rpi.edu

Tolga Cukur, Bilkent University, Turkey.
cukur@ee.bilkent.edu.tr

Hengyong Yu, University of Massachusetts Lowell, USA.
Hengyong_Yu@uml.edu

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